Rice University
Civil and Environmental Engineering

CEVE 420/520 – ENVIRONMENTAL REMEDIATION AND RESTORATION

SPRING 2022 Syllabus

Course objective

The objective of this class is to provide you with the knowledge of the processes, chemicals, technologies, and institutional considerations that you need to select an appropriate method for cleaning up contaminated soil, groundwater, sediment, and surface water that has become adversely impacted by chemicals.

Textbooks

Practical Design Calculations for Groundwater and Soil Remediation, Second Edition by Jeff Kuo, CRC Press; June 2, 2014, ISBN-10: 1466585234.

I will also give you technical papers, other book extracts, and reading assignments from time to time. We will make extensive use of internet resources. I will include the relevant internet links in the lecture notes. Lecture slides will usually be distributed before each lecture. Lectures, lecture recordings, and problem solutions will be posted to Canvas.

Grading

Exams (2)	50%
Homework	25%
Final design project	25%

Exams

Two closed-book exams will be given in class. Both exams will be mostly qualitative with short answers to test your knowledge of specific issues and your understanding of key concepts. There will also be some brief quantitative exam questions to make sure that you know how to apply some of the principles taught.

The final design project will be a combined qualitative assessment and quantitative problem similar to the homework assignments that involves the design of a groundwater capture system and water treatment system.

Homework

Homework assignments will generally be due 1 to 2 weeks after distribution. Assignments and solutions will be posted on Canvas. Grades on late homework assignments will be reduced by 10 percent of the possible homework grade for each day or part of day that they are late. Homeworks focus on quantitative calculations typical of remediation projects. Extensions can be given *with prior arrangement*.

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Final Design Project

For the final design project, you will review and analyze data from real site investigation and feasibility study reports. You will then perform quantitative calculations to support the design of two elements of a groundwater remediation system: a groundwater capture system and a water treatment system.

Field trip to Industrial Site

Conditions permitting, we will take a field trip to an industrial site to see monitoring wells and see active groundwater extraction systems. The trip will be scheduled based on weather conditions and class activities.

Instructor and Office Hours

Phillip C. de Blanc, Ph.D., P.E.
Lecturer in Civil and Environmental Engineering
Ryon Lab Room B30
Phone: 713-348-4725
Mobile: 281-635-6069 (Emergencies only please!)
Email: pcdeblanc@rice.edu

Office hours 2:30 to 3:30 Thursdays.

I check email regularly, and you are encouraged to communicate by email whenever possible. I will usually respond within a few hours, but never more than 24 hours later (except on weekends and holidays).

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1. Introduction - Why clean up the environment?
2. Overview of environmental contamination
    a. Sources and Extent of Chemical Contamination in the U.S. and World
    b. Types of sites
    c. Types of Media Affected with examples
    d. Classes of chemical contaminants
    e. Physical nature of contaminants (dissolved, NAPLs, etc.)
3. Site Investigation
    a. Objectives – ID nature, magnitude, and extent of impacts
    b. Conceptual model
    c. Preliminary assessment
    d. Field investigation techniques
    e. Field testing techniques (slug tests, pumping tests, tracer tests)
    f. Laboratory analyses
    g. Assessing extent of impacted media (interpolation techniques, etc.)
4. Risk Assessment
    a. Fundamentals – dose, pathways
    b. Carcinogenic and non-carcinogenic risk considerations
    c. Forward calculations – determining risk from a site.
    d. Backward calculations – calculating cleanup levels
    e. Statistical methods for cleanup
5. Chemical and Physical Properties Affecting Remediation Technologies
    a. Media Characteristics
    b. Chemical Characteristics
    c. Institutional
6. Remediation objectives and classification of technologies
    a. Remediation Objectives
    b. Classification of Remediation Technologies
7. Technologies for Soil Remediation
8. Technologies for Groundwater Remediation
    a. Groundwater extraction
    b. Ex-situ groundwater treatment
    c. In-situ groundwater treatment
    d. Containment
9. Selection of remedial alternatives
    a. Sources of information on remediation technologies
    b. Factors to consider
    c. Presumptive remedies
    d. Technology evaluation
    e. Assembling technologies into complete alternatives
    f. Criteria for evaluation of alternatives
10. Remediation Design Elements
    a. Treatability testing
    b. Supplementary investigations
    c. Design
    d. Use of models
    e. Cost Optimization
    f. Long-term monitoring/sustainability

11. River and Sediment Remediation and Restoration
    a. Surface water
    b. Sediments
    c. Case studies